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A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

December 9, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: **Docket Nos. 50-361 and 50-362**
Request For Relaxation Of Reactor Pressure Vessel Head Penetration Inspection Requirements In Nuclear Regulatory Commission Order EA-03-009
San Onofre Nuclear Generating Station Units 2 and 3

Dear Sir or Madam,

This letter submits two Southern California Edison (SCE) Company's requests for relaxation (Enclosures 1 and 2) from the February 11, 2003, NRC Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors."

Order EA-03-009 established interim inspection requirements for reactor pressure vessel head (RPVH) penetrations at pressurized water reactors. In SCE's March 3, 2003, letter from A.E. Scherer to the NRC Document Control Desk, SCE consented to the order and indicated at that time that an evaluation was in progress to establish the need for relaxation from certain requirements in the order.

San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 RPVHs are assigned to the high primary water stress corrosion cracking (PWSCC) susceptibility category per Order EA-03-009 parts IV.A and IV.B. Therefore, parts IV.C(1)(b)(i) and IV.C(1)(b)(ii) of Order EA-03-009 contain the requirements addressed in this letter and Enclosures 1 and 2.

Enclosure 1 is Order EA-03-009 Relaxation Request 1; it addresses the proposed alternative to allow a combination of examination methods to fulfill the requirements specified in Order EA-03-009 for the RPVH penetrations.

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Enclosure 2 is Order EA-03-009 Relaxation Request 2; it addresses inaccessible areas related to non-destructive examinations of the Control Element Drive Mechanism (CEDM) and In-Core Instrument (ICI) penetrations. To aid in the review of this request two attachments are provided. Attachment 1 is a drawing of a closure head nozzle. Attachment 2 consists of nine crack growth curve figures.

SCE requests NRC approval of Relaxation Requests 1 and 2 prior to February 9, 2004, when the next Unit 2 refueling outage is scheduled to begin.

Should you have any questions, please contact Mr. Jack Rainsberry, Manager, Plant Licensing at (949) 368-7420.

Sincerely,

Enclosures

cc: B. S. Mallett, Regional Administrator, NRC Region IV
B. M. Pham, NRC Project Manager, San Onofre Units 2, and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3

ENCLOSURE 1

ORDER EA-03-009 Relaxation Request 1

Request For Relaxation From The Requirements Of NRC Order EA-03-009 To Allow A Combination of Non-Destructive Examination Techniques To Fulfill The Inspection Requirements

1. **NRC Order Requirement**

Order EA-03-009, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (Reference 1) requires that only one technique be applied to each reactor pressure vessel head (RPVH) penetration at a given unit.

2. **Proposed Alternative**

Southern California Edison (SCE) Company seeks relaxation from the requirement to use one examination method for all penetrations and proposes that a combination of examination methods be permitted as described below.

3. **Reason for Relaxation Request**

The need for this request is prompted by the following:

- The reactor vessel vent line penetration is not installed with an interference fit, rendering the option of using part IV.C(1)(b)(i) not applicable.
- From previous examinations, the incore instrumentation (ICI) nozzles are known to have distortion near the bottom of the nozzle, which makes it difficult to meet the requirements of part IV.C(1)(b)(i).
- The geometry of the ICI penetrations can not be completely examined using ultrasonic testing (UT) to the requirements of part IV.C(1)(b)(i). Using eddy current testing (ET) per part IV.C(1)(b)(ii) to inspect the ICI penetrations will allow a more complete examination.
- SCE plans to use UT following the requirements of part IV.C(1)(b)(i) for control element drive mechanism (CEDM) penetrations. However, some CEDM penetrations may exhibit geometric interference that prevents meeting the requirements of part IV.C(1)(b)(i). When such interference is encountered, SCE proposes to perform a wetted surface examination for those penetrations in accordance with the requirements of part IV.C(1)(b)(ii).

4. **Basis for Relaxation**

All RPVH penetrations at San Onofre Nuclear Generating Station, Units 2 and 3 have open housings; there are no thermal sleeves installed in any of the penetrations. The Westinghouse inspection probe that will be used provides the ability to scan the inside surface with eddy current testing (ET) while simultaneously inspecting the volume of the penetration nozzle with ultrasonic testing (UT). SCE intends to meet the requirements of EA-03-009 for CEDM penetrations by performing examinations using UT in accordance with the requirements of part IV.C(1)(b)(i).

In addition to the above, SCE plans to perform supplemental surface examinations of each J-groove weld surface using ET. The supplemental inside diameter (ID) ET and J-groove weld surface examinations are planned for each CEDM and ICI penetration. SCE intends to meet the inspection requirements of EA-03-009 for ICI and vent line penetrations using ET, or dye penetrant testing if necessary, in accordance with the requirements of part IV.C(1)(b)(ii).

The proposed alternative to requirements of EA-03-009 provides an equivalent level of quality and safety, and any combination of the requirements of part IV.C(1)(b)(i) or IV.C(1)(b)(ii) may be applied to satisfy the requirements of order EA-03-009 provided one part is selected as the examination method for any one penetration.

5. **Duration of Proposed Alternative**

The proposed alternative will apply only during the period in which NRC Order EA-03-009 is in effect.

6. **Precedents**

Letter from William H. Ruland (NRC) to A. Christopher Bakken III (Indiana Michigan Power Company), dated June 17, 2003; Subject: Donald C. Cook Nuclear Plant, Unit 2, - Relaxation of the Requirements of Order (EA-03-009) Regarding Reactor Pressure Vessel Head Inspections, (TAC No. MB9543)

7. **Reference**

1. U. S. Nuclear Regulatory Commission (NRC) Order EA-03-009, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors, dated February 11, 2003

Enclosure 2

ORDER EA-03-009 Relaxation Request 2

Request For Relaxation From The Requirements Of NRC Order EA-03-009 To Address Inaccessible Areas Respective To Non-Destructive Examinations

1. NRC Order Requirement

NRC Order EA-03-009, Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (Reference 1) established interim inspection requirements for reactor pressure vessel head (RPVH) penetrations.

Part IV.C(1)(b)(i) of EA-03-009 requires an examination from two (2) inches above the J-groove weld to the bottom of the nozzle

Part IV.C(1)(b)(ii) of EA-03-009 requires an examination of the wetted surface of each J-groove weld and RPVH penetration nozzle base material to at least two (2) inches above the J-groove weld.

2. Proposed Alternative

Southern California Edison (SCE) Company seeks relaxation from Order EA-03-009 where inspection coverage is limited by inaccessible areas of RPVH penetration nozzles with respect to nondestructive examination (NDE), including ultrasonic testing (UT), eddy current testing (ET), and dye penetrant testing (PT).

a) Control Element Drive Mechanism (CEDM) Penetrations

SCE proposes to examine each CEDM nozzle from 2 inches above the top of the attachment weld to at least 0.30 inches below the bottom of the attachment weld.

In the event that data cannot be to at least 0.30 inches below the bottom of the weld, SCE proposes to add a supplemental surface examination of the outside diameter (OD) surface of the affected penetration. The OD surface examination would cover the area of the penetration that data could not be collected from the inside diameter (ID) surface.

b) Incore Instrumentation (ICI) Penetrations

SCE proposes to examine the wetted surface on the ICI penetrations in accordance with the requirements of part IV.C(1)(b)(ii). This examination will include the ID surface, the OD surface, and the surface of the J-groove attachment weld. The examination will not include the bottom face of the ICI nozzle. A surface examination of the bottom face of the affected ICI nozzles will be performed at any location where the bottom face is within 0.3 inches of the attachment weld.

3. **Reason for Relaxation Request**

a) **CEDM Penetrations**

The material near the bottom of each CEDM nozzle cannot be inspected due to the presence of a CEDM extension shaft guide cone threaded to the ID surface. The length of the ID surface of each CEDM nozzle that cannot be inspected is approximately 1.5 inches.

A drawing showing detailed dimensions of a CEDM penetration is provided as Attachment 1 (SO23-901-213, Revision 1). In the discussions regarding distances below the J-groove weld, the J-groove weld is assumed to include the associated fillet weld.

b) **ICI Penetrations**

There is no remote examination equipment available to inspect the bottom face of the ICI nozzles.

4. **Basis for Relaxation**

The phenomenon of concern is primary water stress corrosion cracking (PWSCC), which typically initiates in the areas of highest stress. The area of CEDM and ICI penetrations that has the highest residual stress is the area adjacent to the J-groove attachment weld. Therefore, it is most probable that PWSCC will initiate adjacent to the J-groove attachment weld. PWSCC at or above the attachment weld resulting in pressure boundary leakage and the potential development of a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel RPVH) prompted the NRC to issue Order EA-03-009. The inspections performed at San Onofre Nuclear Generating Station (SONGS) will ensure the integrity of the pressure boundary.

In previous NRC reviews of relaxation requests for uninspectable areas of RPVH penetrations, the NRC has requested that an analysis be performed to characterize the potential growth of cracks in the uninspected areas. This type of analysis has been performed for SONGS Units 2 and 3. Results from the SONGS specific structural integrity evaluation of RPVH penetrations are provided in Figures 6-10 through 6-18 from Westinghouse Report WCAP-15819, May 2002, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: San Onofre Units 2 and 3 (Attachment 2).

4. Basis for Relaxation (continued)

a) CEDM Penetrations (continued)

The crack growth rate curve that was used to develop the SONGS specific curves presented in Attachment 2 is conservative relative to the accepted curve in MRP-55, Revision 1 (Reference 2). The results of the SONGS specific structural integrity evaluation show that a through wall axial crack growing from 0.30 inches below the weld would take at least 21 months at operating conditions to reach the bottom of the weld. This time frame is longer than the typical SONGS operating cycle.

The uninspectable area of the CEDM penetrations is below the attachment weld where operating pressure is equalized across the penetration and does not contribute to the tensile stress in the penetration. Further, as distance from the weld increases, the residual stress levels drop dramatically. Therefore, postulating a through wall crack originating from this relatively low stress area below the weld and impinging on the inspected area is considered very conservative.

However, if a through wall axial crack exists in the uninspected region near the bottom of a CEDM nozzle and propagates toward the J-groove weld, it would be detected during the next inspection interval prior to propagating to the bottom of the J-groove attachment weld. This does not include the time that would be required for an axial crack to propagate through the attachment weld and result in a leakage path.

Additional operating time would be required for a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel RPVH) to develop as a result of that leak. Therefore, multiple inspection intervals will be available to detect a flaw that initiates in the uninspected region prior to potential development of a safety concern.

The threaded portion of the extension shaft guide cone would serve to retain potential loose parts resulting from a circumferential crack in the uninspected area. A postulated 360-degree through wall crack in the narrow uninspected annulus above the guide cone threads could result in separation of the guide cone from the penetration. However, in that case, the guide cone would be retained by the control element assembly (CEA) shroud and associated CEA Extension shaft. This condition would not interfere

4. **Basis for Relaxation (continued)**

a) **CEDM Penetrations (continued)**

with CEA function or any other reactor coolant system function, and would be readily observed in the subsequent refueling outage.

Based on a review of data acquired during the Unit 2, Cycle 12 refueling outage, it is anticipated that examination data will be collected from 2 inches above the top of the attachment weld to at least 0.30 inches below the bottom of the attachment weld in all 91 CEDM penetrations. The proposed inspection scope to at least 0.30 inches below the attachment weld provides at least one additional inspection interval to detect cracks propagating from the uninspected area to the bottom of the weld and multiple inspection intervals will be available to detect cracks propagating from the uninspected area before they could develop into a safety concern.

b) **ICI Penetrations**

The crack growth rate curve that was used to develop the SONGS specific curves presented in Attachment 2 is conservative relative to the accepted curve in MRP-55, Revision 1 (Reference 2). The results from a SONGS specific structural integrity evaluation of RPVH penetrations (Attachment 2) show that a through wall axial crack growing from 0.30 inches below the weld would take at least 21 months at temperature to reach the bottom of the weld. This time frame is longer than the typical SONGS operating cycle.

Therefore, there is reasonable assurance that a through wall axial crack existing on the uninspected region on the bottom face of an ICI nozzle that propagates toward the J-groove weld would be detected during the next inspection interval prior to the crack propagating to the bottom of the J-groove attachment weld. This does not include the time that would be required for an axial crack to propagate through the attachment weld and result in a leakage path.

Additional operating time would be required for a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel RPVH) to develop as a result of that leak. Therefore, multiple inspection intervals will be available to detect a flaw that initiates in the uninspected region prior to potential development of a safety concern.

4. Basis for Relaxation (continued)

As described in NRC Order EA-03-009, the safety concern related to PWSCC and subsequent system leakage through a RPVH penetration and/or a J-groove attachment weld is a loss of coolant accident caused by ejection of a nozzle or corrosion of the low-alloy steel RPVH, or both. The results of the SONGS specific structural integrity evaluation indicate that, even if a flaw were present in the portion of the nozzle that cannot be inspected with current inspection technology, there would be adequate opportunity for detection prior to the flaw compromising the reactor coolant system pressure boundary.

Therefore, the proposed alternatives, combined with the other provisions of the NRC order, and the proposed supplemental examinations, provide adequate protection with respect to the identified safety concern. Accordingly, SCE considers that the proposed alternatives provide an acceptable level of quality and safety.

5. Duration of Proposed Alternative

The proposed alternative will apply only during the period in which NRC Order EA-03-009 is in effect.

6. Precedent

Letter from Scott W. Moore (NRC) to J. A. Stall (FP&L), dated May 29, 2003; Subject: Saint Lucie Nuclear Plant, Unit 2 - Order EA-03-009 Relaxation Request Nos. 1 and 2 Regarding Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles (TAC Nos. MB8165 and MB8166)

7. References

1. U. S. Nuclear Regulatory Commission (NRC) Order EA-03-009, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors, dated February 11, 2003

2. EPRI Technical Report Materials Reliability Program Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick-Wall Alloy 600 Materials (MRP-55), Revision 1

8. Attachments

1. Southern California Edison Drawing SO23-901-213-01, Closure Head Details

2. Figures 6-10 through 6-18 from Westinghouse Report WCAP-15819, May 2002, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: San Onofre Units 2 and 3"

ENCLOSURE 2

Attachment 1

Southern California Edison Drawing
SO23-901-213-01
Closure Head Nozzle Details

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:"CLOSURE HEAD NOZZLE DETAILS SAN ONOFRE III."

DWG NO . 234-659

WITHIN THIS PACKAGE.

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ENCLOSURE 2

Attachment 2

Figures 6-10 through 6-18
From
Westinghouse Report WCAP-15819,
May 2002,
"Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to
Support Continued Operation:
San Onofre Units 2 and 3"

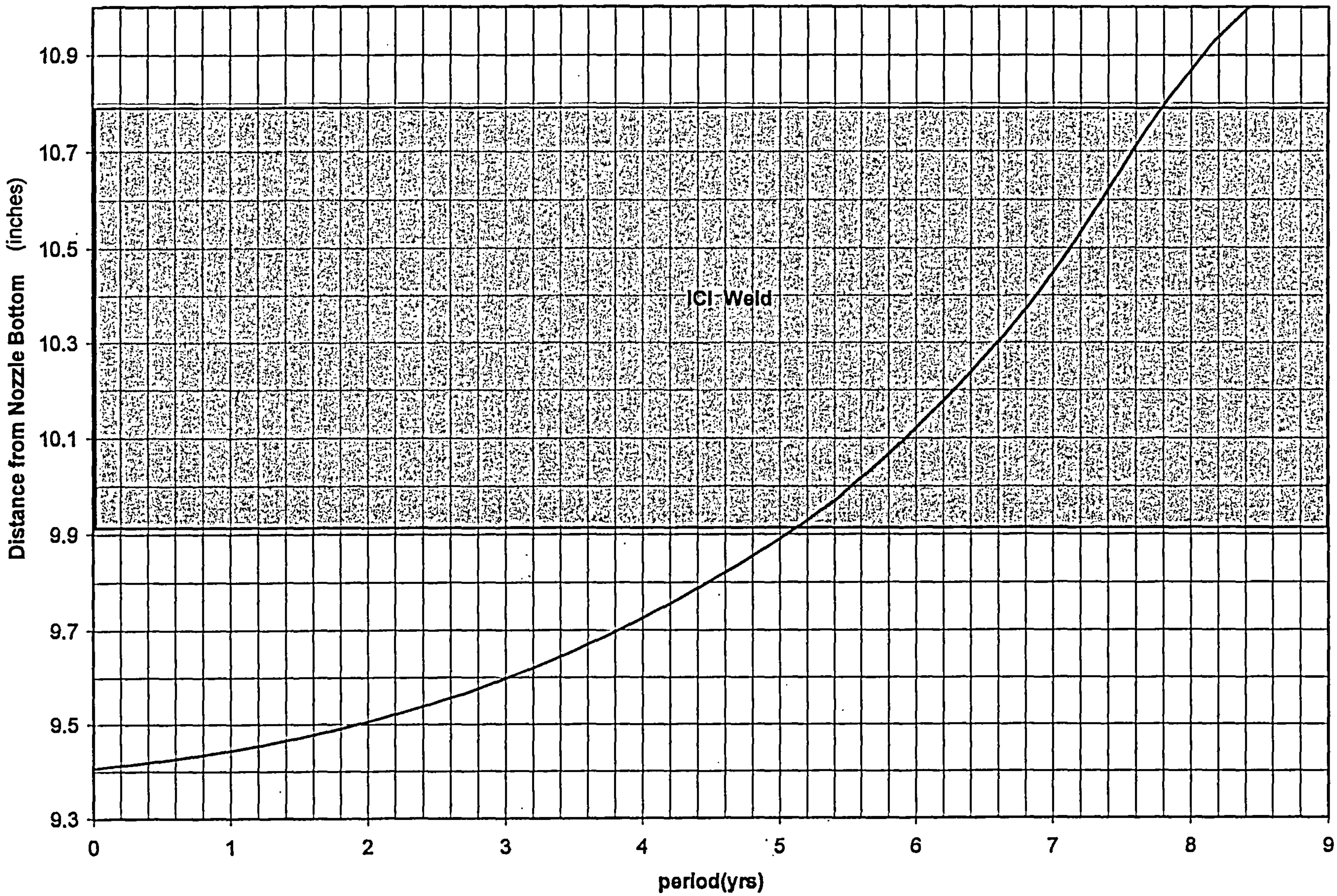

Figure 6-10 Crack Growth Predictions for Through-Wall Axial Flaws Located in the ICI Penetrations (55.3 degrees), Uphill Side

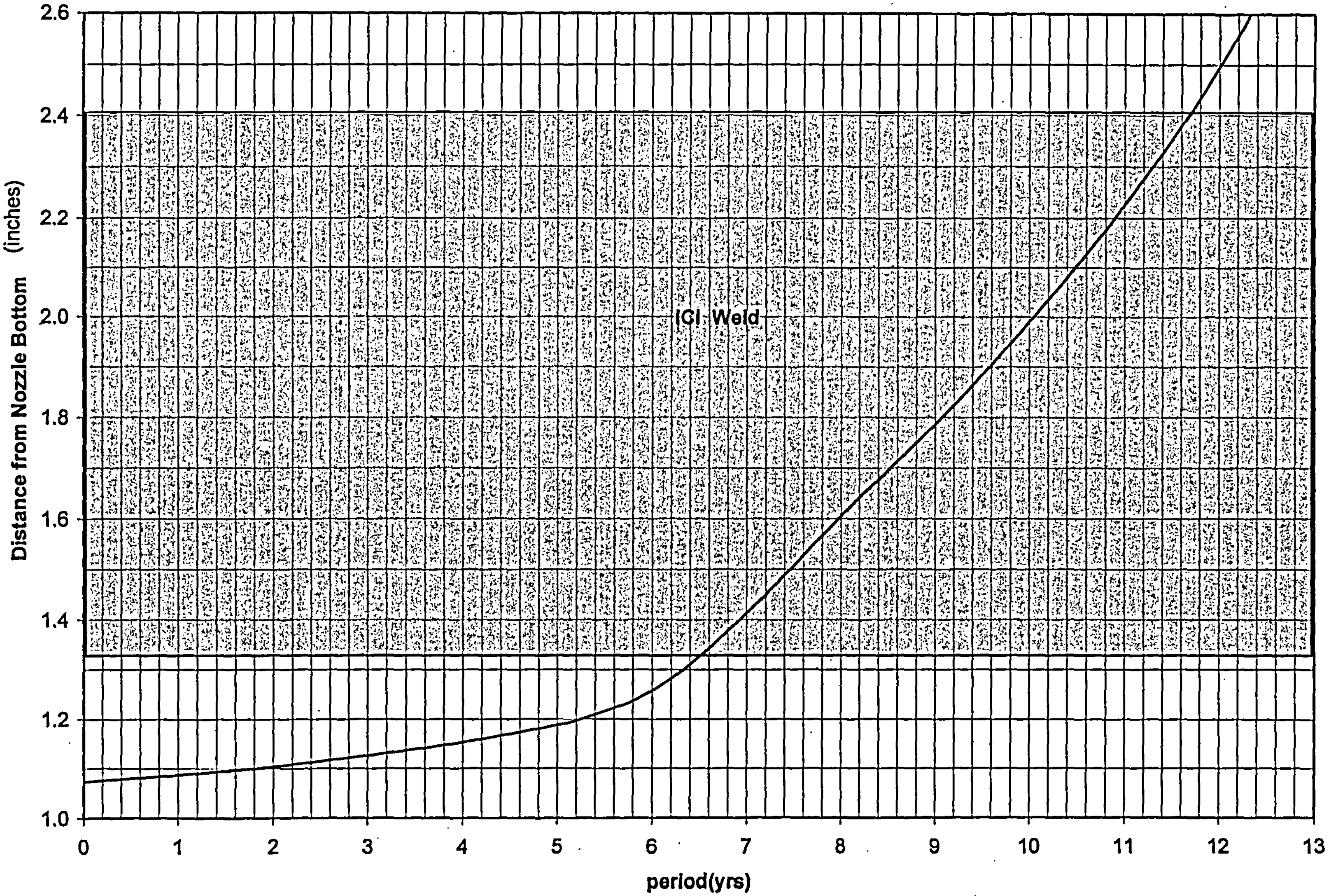

Figure 6-11 Crack Growth Predictions for Through-Wall Axial Flaws Located in the ICI Penetrations (55.3 degrees), Downhill Side

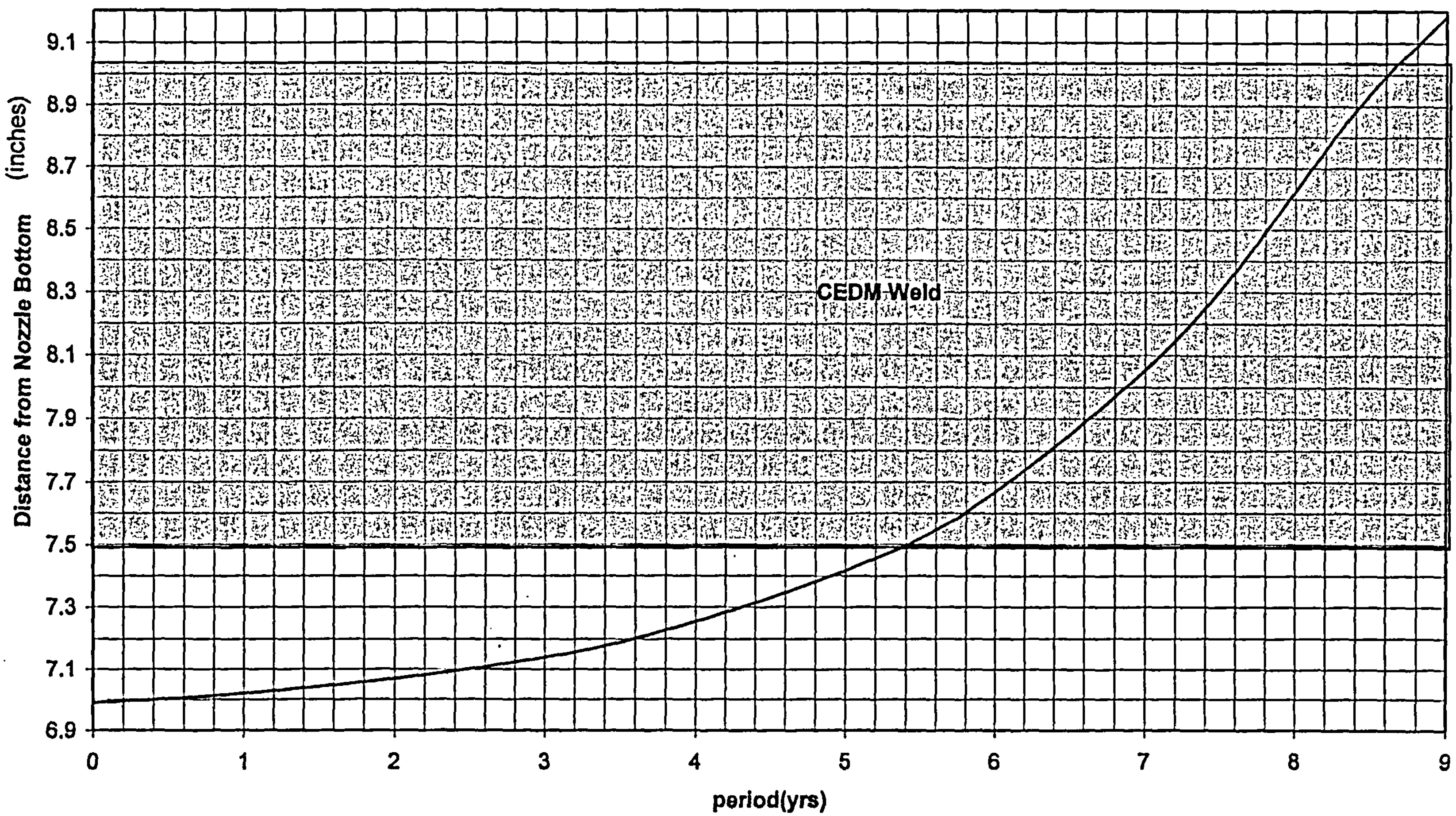

Figure 6-12 Crack Growth Predictions for Through-Wall Axial Flaws Located in the Outermost CEDM (49.7 Degree) Row of Penetrations - Uphill Side

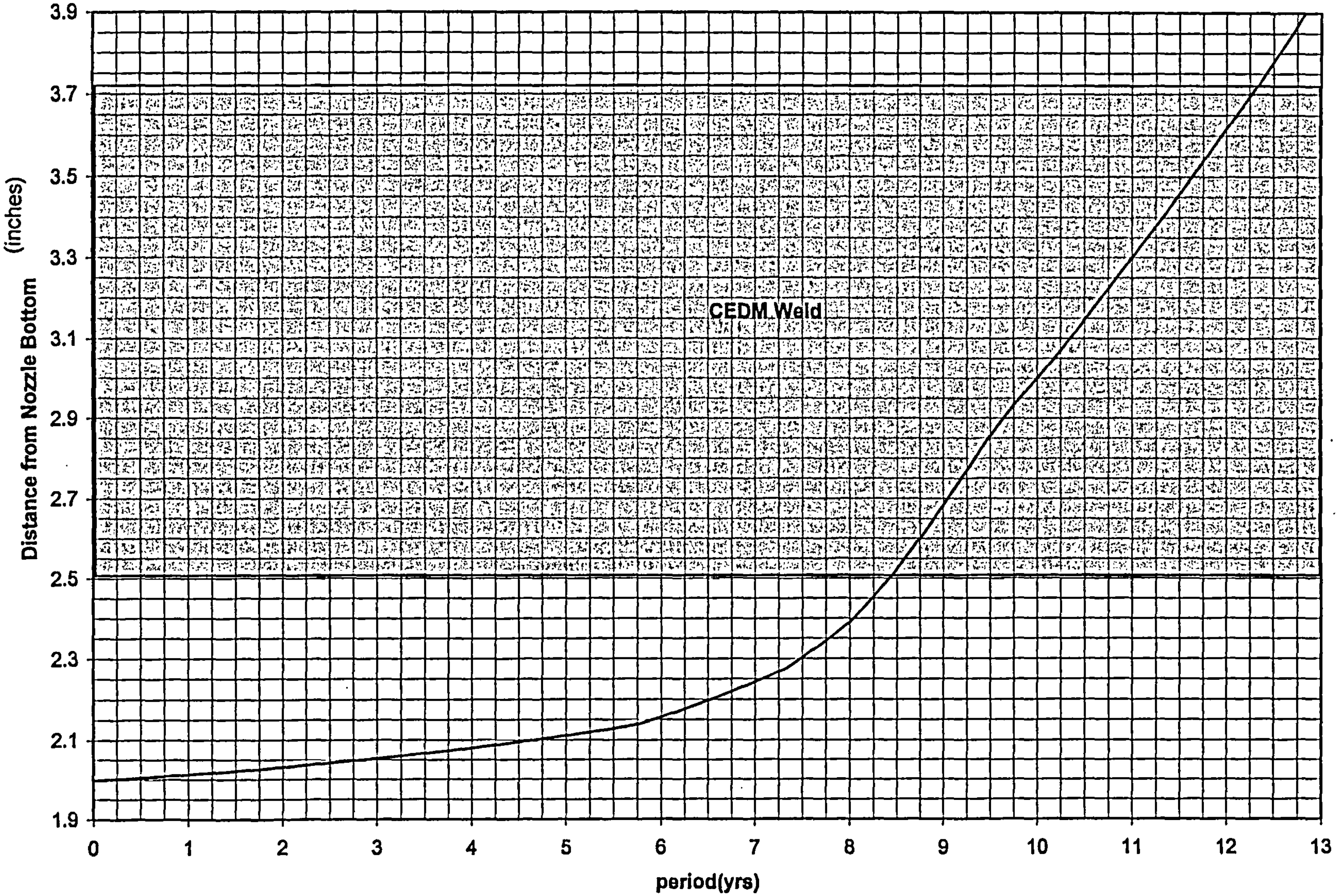

Figure 6-13 Crack Growth Predictions for Through-Wall Axial Flaws Located in the Outermost CEDM (49.7 Degree) Row of Penetrations - Downhill Side

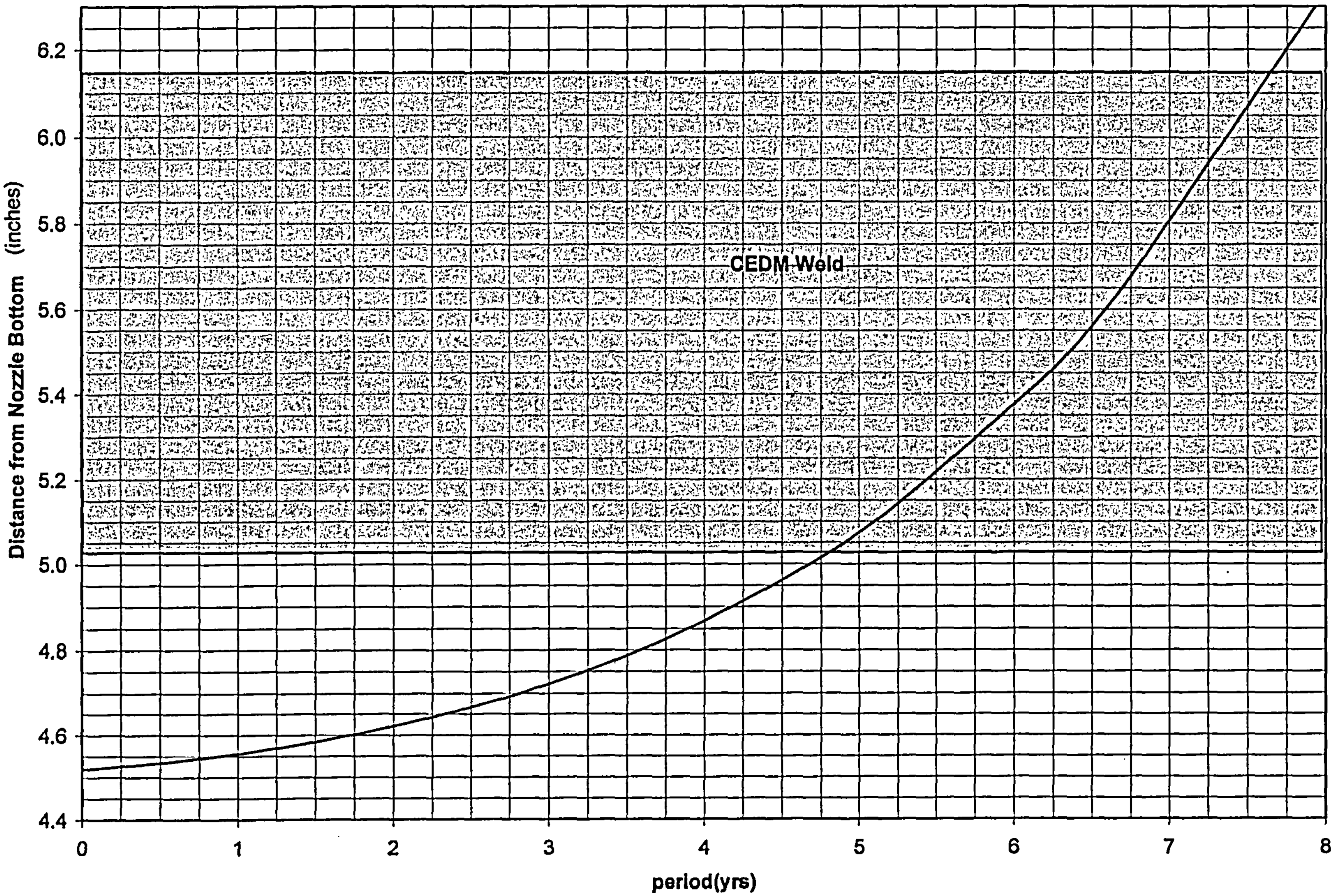

Figure 6-14 Crack Growth Predictions for Through-Wall Axial Flaws Located in the 29.1 Degree Row of Penetrations - Uphill Side

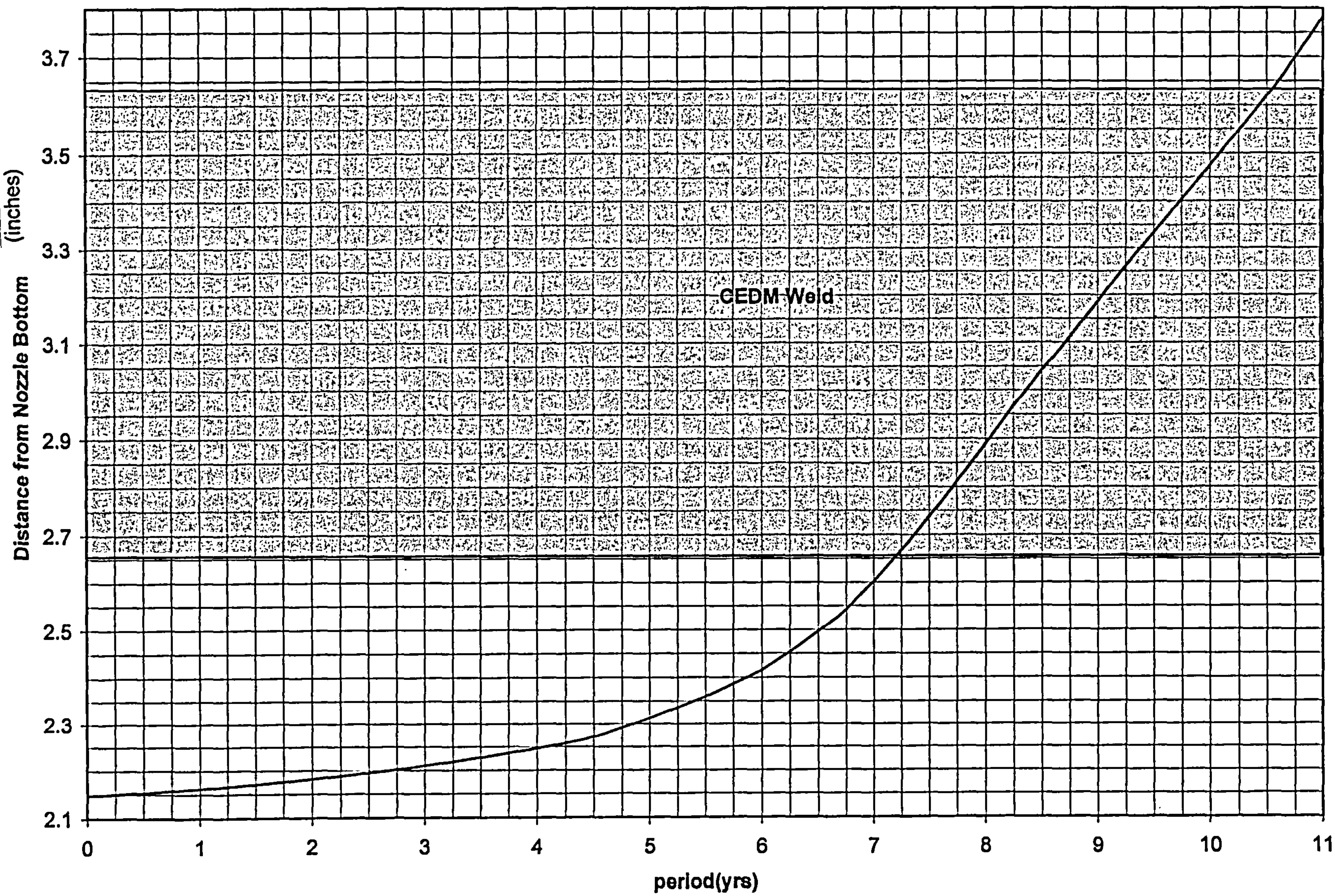

Figure 6-15 Crack Growth Predictions for Through-Wall Axial Flaws Located in the 29.1 Degree Row of Penetrations - Downhill Side

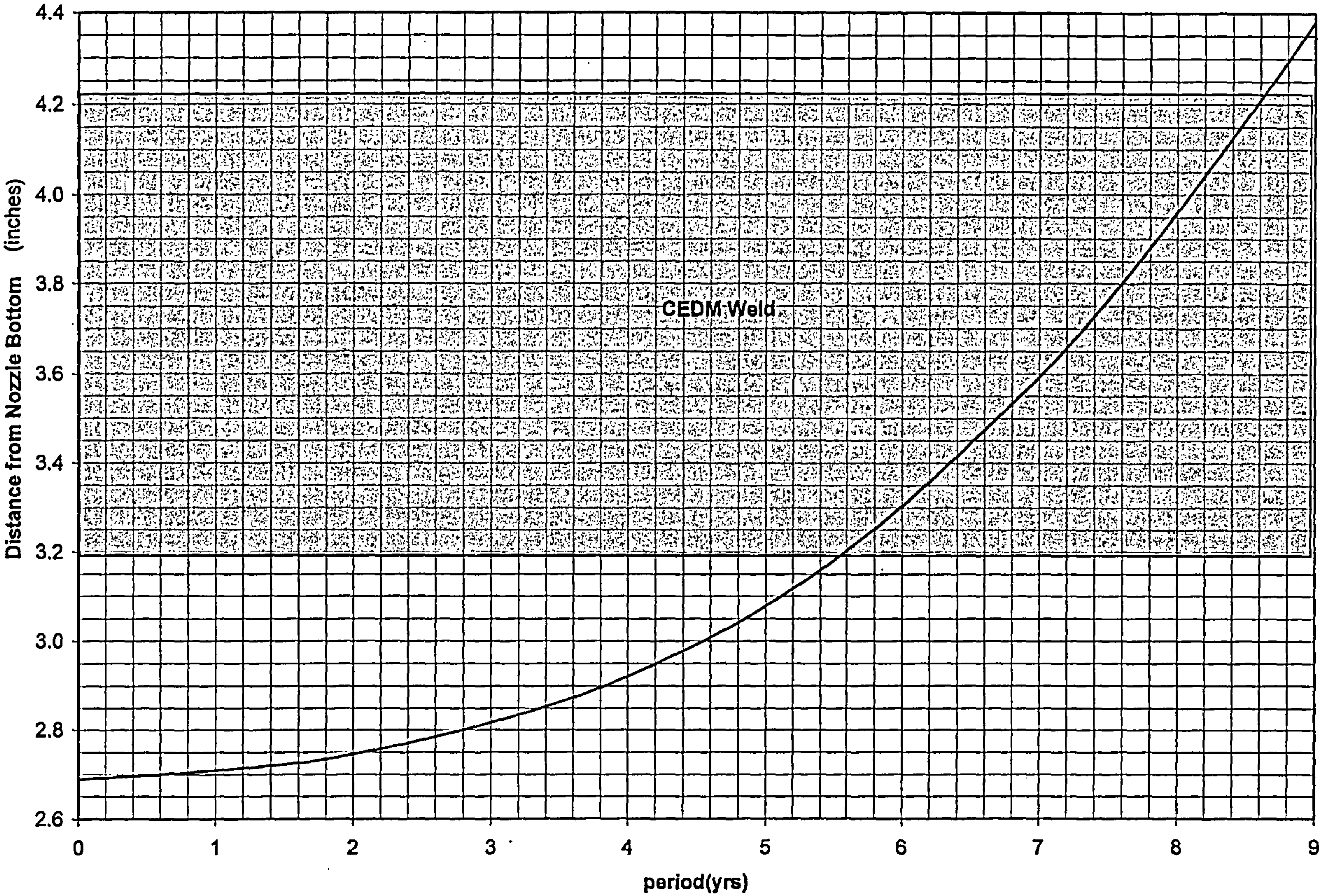

Figure 6-16 **Crack Growth Predictions for Through-Wall Axial Flaws Located in the 7.8 Degree CEDM Uphill Side**

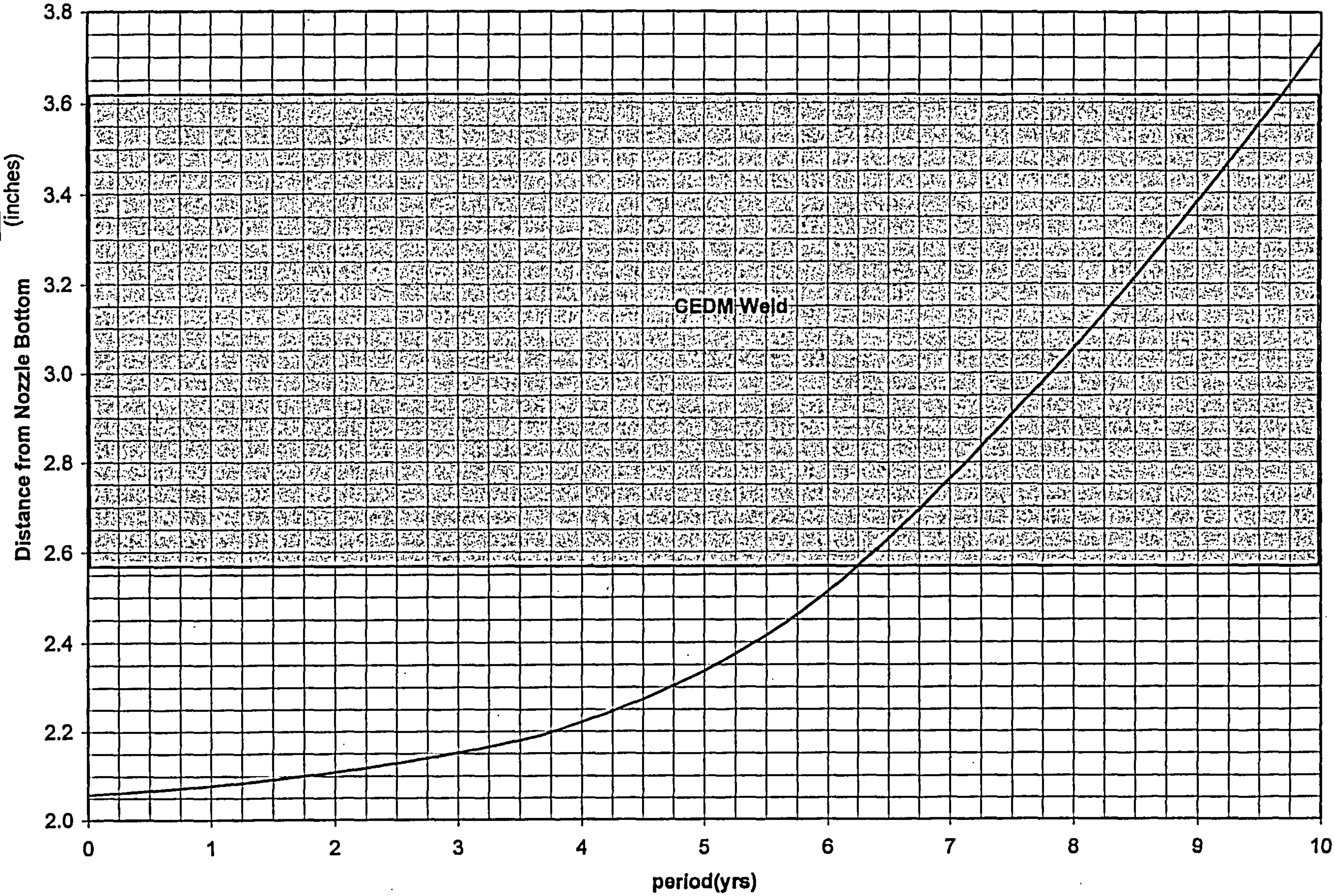

Figure 6-17 Crack Growth Predictions for Through-Wall Axial Flaws Located in the 7.8 Degree CEDM Downhill Side

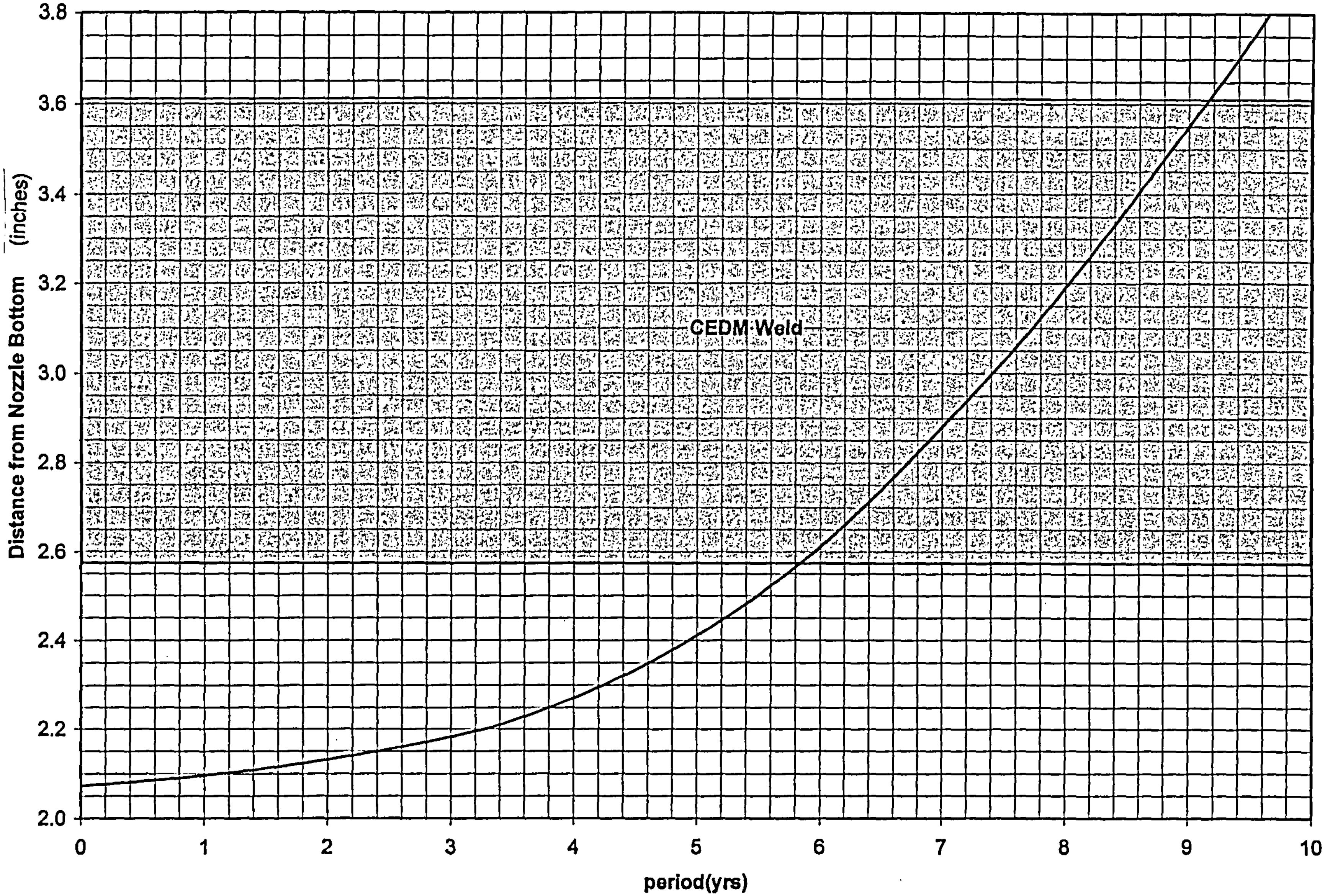

Figure 6-18 Crack Growth Predictions for Through-Wall Axial Flaws Located in the Center Penetration